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POPULAR AND PRACTICAL ENTOMOLOGY.

PRACTICAL RESULTS IN SPRAYING A COMMERCIAL

ORCHARD FOR THE GREEN APPLE BUG.

BY W. H. BRITAIN, PROVINCIAL ENTOMOLOGIST FOR NOVA SCOTIA.

The cost of spraying for sucking insects is so much higher than for fungous diseases and biting insects, that even progressive fruit growers sometimes hesitate before applying the remedies recommended for insects of this type. In the case of orchard aphids, it is often difficult to advise a definite course of action—outbreaks of these insects are so dependent upon climatic conditions and the action of parasitic and predaceous enemies. In the case of severe infestations of the Green Apple Bug (*Lygus communis* var. *novascotiensis* Knight), no such hesitation need be experienced. An abundance of data has now been accumulated, which shows that even when a single year only is considered, economically profitable results can be expected, though, of course, the benefit from the work should be considered over a period of years. The tables accompanying this paper give details of the results of control operations in one orchard. Needless to say, such results can only be obtained by a thorough knowledge of the life-history and habits of the pest and by the most thorough and searching work.

The orchard for experiment was taken over in 1917 as a demonstration in the control of the Green Apple Bug. One part, comprising approximately 6 acres, consisted of very large 60 year old trees of mixed varieties; another part consisted of about four acres of 30 year old trees, mostly Golden Russets. The remainder consisted of a mixed lot of trees of varying ages, but mostly younger than the Golden Russets, comprising between two and three acres. This lot was very thickly planted and set with fillers of plums, pears, etc.

The work of the insects was first noticed in the old orchard where the infestation was still most severe. Here it was gradually rendering the trees worthless, reducing the crops of the chief

varieties to such an extent as to scarcely repay picking. The work of the insects was, for the three years in which we had it under observation, so severe that most of the blossoms would be stung to death before forming fruit. In most cases these trees would blossom heavily, but any fruit that was able to set would soon be punctured by the bug and either drop to the ground or develop into a gnarled or twisted apple. The damage to the smaller twigs was also very apparent, a great deal of the fruiting wood being severely damaged by repeated punctures and covered with scars resulting therefrom. Much of the young growth had been killed outright. The past was now becoming similarly injurious in the Golden Russet orchard and, while the damage to the twigs had not here reached such a state as in the older trees, the crop was gradually and steadily being destroyed. Finally, the bug was rapidly gaining a foothold in the remaining part of the orchard, though the infestation was far from being as severe as in the rest.

The whole orchard, with the exception of the smallest part mentioned above, which was sprayed by the owner, was treated for Green Apple Bug, nicotine sulphate (blackleaf 40), 1 pint to 100 gals. being used. In the spray immediately before the blossoms opened, this was combined with lime sulphur and arsenate of lime. In the after-blossom spray, the fungicide was sodium sulphide ("soluble sulphur") and the arsenical poison was omitted. All our attention was concentrated on spraying for the bug, and when weather conditions were such that injury from the application of the fungicide seemed likely, it was omitted from the spray. A "Friend" spray gun was used throughout the work, as this instrument proved more effective than the ordinary nozzles.

On the Golden Russet orchard and on the Gravensteins in the large orchard, the spray was applied under ideal conditions and resulted in the practical elimination of the bug. A few might still be found in the tops of the trees, but their number was insignificant and they were able to accomplish little damage. In the remainder of the old trees, trouble with the outfit resulted in considerable delays, and most of this block failed to receive the first and most important spray, so that it was only with great difficulty and by

taking the utmost pains that we were able to secure a fair measure of control.

In analyzing the results of this work we are unable to make comparison with check plots, as the owner did not desire to leave any trees untreated, and to have done so would have disturbed our

COMPARISON OF VALLEY CROP WITH THAT OF EXPERIMENTAL ORCHARD.

TABLE No. 1.

| Year | Total crop for entire valley. bbls. | Percentage of previous seasons' crops | Total actual crop in orchard | Percentage of previous years crops all varieties | Total theoretical crop in orchard | No. bbls. Grav. | No. bbls. Nonpareils | No. bbls. Russets |
|-------|-------------------------------------|---------------------------------------|------------------------------|--|-----------------------------------|-----------------|----------------------|-------------------|
| 1910. | 323,000 | | | | | | | |
| 1911 | 1,740,000 | 538.7 | 2200 | | | 220 | 95 | 600 |
| 1912 | 993,338 | 57.1 | 1800 | 81.4 | 1256 | 206 | 55 | 400 |
| 1913 | 650,901 | 65.5 | 1300 | 72.4 | 1179 | 123 | 110 | 81 |
| 1914 | 650,900 | 100.0 | 780 | 60. | 1300 | 159 | 4 | 75 |
| 1915 | 613,882 | 94.3 | 500 | 71.8 | 735 | 90 | 1 | 46 |
| 1916 | 681,470 | 111.0 | 300 | 64.3 | 621 | 39 | 3 | 25 |
| 1917 | 744,730 | 109.26 | 1465 | 406.9 | 393 | 246 | 75 | 330 |

sprayed plots to some extent, owing to the flying in of adults from the untreated plots. It was, therefore, necessary to compare the quantity and quality of apples obtained in 1917 with that obtained in previous years, and further to compare this with the general crop for the whole Valley over the same period. This is to make certain that the results obtained actually represent the effects of our work, and not of other factors which might have operated over the entire district. Last of all, we will compare the results obtained by our own work with those obtained on the portion sprayed by the owner, as far as this is possible. In doing so, it should be remembered that the conditions in that part were not ideal for good work and that the comparative inexperience of the man who did the spraying, would render effective control unlikely. On the other hand, however, the infestation in this part of the orchard was much lighter than the rest.

Table No. 1 shows that in 1911 there was a phenomenally large crop, following an abnormally low one of the previous year. The crop of 1912 was also large, but since that year the fluctuations have not been wide.

For the purpose of better emphasizing the result of our work in the orchards, the table gives not only the actual crop, but also a "theoretical crop." This is obtained by calculating the crops which the orchard would have yielded had it followed the general average for the Valley. For example, the crop for the entire Valley in 1916, was 111% of the 1915 crop. The 1915 crop in the experimental orchard was 560 barrels; therefore, the theoretical crop could be 621 barrels, though the actual crop was considerably below that figure, viz., 300 barrels. By comparing the theoretical crop, obtained in this way with the actual crop, we find that up to and including the year 1913 the crop in the orchard is better than the average, but in 1914, it dropped below and continued to do so every year until 1917. This period corresponds with the increasing severity of the infestation of the Green Apple Bug as shown by actual observation. The figures for the three leading varieties show in a very striking manner the steady falling off in yield, and no one who watched the work of the pest in the orchard could doubt that it was the cause of the decline. In 1917, the year the treatment was given, the crop for the entire Valley was 109.26% of the previous crop, while the crop in the orchard was 406.9% of the crop of the previous year. Expressed differently, the actual crop was 1,469 barrels, while the theoretical was 393 barrels.

PERCENTAGE OF DIFFERENT GRADES OF ALL VARIETIES
IN ENTIRE VALLEY AND IN EXPERIMENTAL ORCHARD

TABLE No. 2.

| Year | Per Cent. of Different Grades in Entire Valley. | | | Per cent. of Different Grades in Experimental Orchard. | | |
|------|--|-------|-------|---|-------|-------|
| | No. 1 | No. 2 | No. 3 | No. 1 | No. 2 | No. 3 |
| 1912 | 39.5 | 15.2 | 45.3 | 49.6 | 16. | 34.4 |
| 1913 | 32.10 | 14.4 | 53.5 | 33.9 | 18.4 | 47.7 |
| 1914 | 50.1 | 23.3 | 26.6 | 59.3 | 22.4 | 18.3 |
| 1915 | 34.1 | 11.1 | 54.8 | 22.2 | 7.6 | 70.2 |
| 1916 | 40.3 | 18.9 | 40.8 | 49.9 | 18.8 | 31.3 |
| 1917 | 34. | 20.8 | 45.2 | 65.3 | 12.4 | 22.3 |

PERCENTAGE OF DIFFERENT GRADES OF ALL VARIETIES
IN EXPERIMENTAL ORCHARD, IN 1917.

TABLE No. 3.

| Variety | Per Cent. of Different Grades on Portion Sprayed by Owner. | | | Per Cent. of Different Grades on Portion Sprayed by Department. | | |
|------------------|--|-------|-----------------|---|-------|-----------------|
| | No. 1 | No. 2 | No. 3's & Culls | No. 1 | No. 2 | No. 3's & Culls |
| Grav..... | 28.0 | 4.6 | 66.5 | 43.5 | 9.6 | 46.9 |
| Ribston..... | 53.8 | 19.4 | 19.4 | 77.3 | 9. | 13.7 |
| Kings..... | 33.5 | 19.3 | 47.2 | 72.1 | 13. | 14.9 |
| Mann..... | 53.8 | 17.4 | 28.8 | | | |
| Wagner..... | 37. | 25. | 38. | | | |
| Can. Orange..... | 40.8 | 28.9 | 30.3 | | | |
| Pewaukee..... | 40. | 40. | 20. | | | |
| Golden Russet.. | | | | 20.9 | 40.3 | 29.8 |
| Blenheim..... | | | | 74.3 | 11. | 14.7 |
| Baldwin..... | | | | 66.4 | 12.9 | 20.7 |

It should be noted here that the orchard in question has always received better than average care. Before the infestation of the bug began to make itself felt, it yielded crops considerably above the average. It has always been sprayed for apple scab and biting insects, and the quality of fruit has generally been better than the average in spite of the increasing number of gnarled and twisted fruit due to the work of the bug. The percentage of different grades obtained since 1911, is shown in Table No. 2.

Lastly, a comparison of the different grades of fruit in the orchard treated by us and by the owner, shows a decided advantage in favour of the former, as shown by Table No. 3. This was largely due to the smaller percentage of twisted fruit, as the scab control was about equal. As previously stated, the natural infestation in that part of the orchard treated by the owner was much lighter than in the remainder.

A comparison of the conditions in the experimental orchard in 1918 with those of the previous season is of interest. This year the orchard was not sprayed for the Green Apple Bug. Careful examination of the orchard shows that in the older, larger trees, there is still a considerable infestation, though not quite so severe as formerly, while in the Golden Russet orchard, where it will be remembered the best work was done in 1917, the pest could only be found by searching. The necessity of doing timely, thorough work from the standpoint of future years' infestations, is thus further emphasized.

NOTES ON CHALEPUS RUBRA WEB., IN NEW JERSEY.

BY ALAN S. NICOLAY AND HARRY B. WEISS,* NEW BRUNSWICK, N. J.

This species occurs throughout New Jersey, and according to Smith's List is common during May, June and September on locust and sometimes on basswood. Blatchley in his "Coleoptera of Indiana" states that it occurs on locust, oak, soft maple and basswood. Neither of these publications mentions the leaf mining habits of the larva. Chittenden, in his paper on "The Leaf-Mining Locust Beetle with Notes on Related Species," (Bull. 38, N. Ser., U. S. Div. Ent.) states that Harris discovered the larva in 1827 mining the foliage of white oak (Harris, Bost. Jour. Nat. Hist., vol. I, pp. 141-151, 1835) and further records it from New York during June and as late as September.

According to Beutenmuller, it mines the leaves of apple and linden, and the adult is recorded as occurring on white birch, hornbeam, cherry, Juneberry and *Pyrus arbutifolia*. Harris in his "Insects Injurious to Vegetation" lays stress on its importance as an apple pest and mentions chokecherry and shadbush as additional food plants. Chittenden (loc. cit.) states that its life-history appears to be similar to that of the locust beetle *C. dorsalis* Thunb., and records from published statements that the beetles appear during the last of May and deposit eggs on the host leaves in which the larvæ mine. The eggs are described as small, round and of a blackish colour, being fastened to the surface of the leaf either singly or in groups of four or five.

In New Jersey we have found the mines not uncommon on the leaves of various species of oaks, each one usually being at the edge of a leaf. The larva eats all of the parenchyma in its mine resulting in the mine being visible on both leaf surfaces. It shows plainest, however, on the upper surface as a white elongate irregular discoloration. During the last half of June and first half of July the larvæ can be readily found within their mines. We have never found more than one larva in a mine. The pupal stage requires about two weeks and occurs the last week in July and first part of August, the beetles emerging during the second week of August and later. After emerging from the pupa case the beetles are light yellowish red, without distinct markings.

*The arrangement of the authors' names is alphabetical.
December, 1918

After remaining in the larval mines for several days the colours become darker and the markings more distinct.

Full grown larva. Length 7.5 mm. Elongate, composed of 13 segments, very little tapering posteriorly. Colour white except the head, most of the first thoracic segment, legs and upper side of anal segment, which are brownish or brownish red. Thoracic and abdominal segments convex above and less so below. Head subquadrate, flat, shining, with median dorsal line groove terminating in an inverted V. Head about $\frac{1}{2}$ the greatest width of the first thoracic segment. Antennæ 3-jointed, joints of equal length. First thoracic segment $1\frac{1}{2}$ times the length of the second. Second and third of equal length. Thoracic segments of equal width, sides arcuate. Sides of abdominal segments 1 to 8 produced into triangular tubercles (giving abdomen a notched appearance) capped with minute globular tubercles bearing several minute hairs. First thoracic segment bearing a faint, median dorsal impressed line with a transverse, foveiform impression on either side. Dorsal surface of 2nd and 3rd thoracic segments and abdominal segments 1 to 8 each with a transverse, median impression and a short, oblique one on either side. Ventral surface of abdominal segments 1 to 8 similar to dorsal surface except that the transverse impressions are somewhat curved. Nine pairs of stigmata, one pair on second thoracic segments, and a pair each on all abdominal segments except the 8th. Each abdominal spiracle situated at the base of the lateral tubercle a little before the middle of the segment, the ninth pair in the dorsal surface of the anal segment. Thoracic and anal stigmata larger than the others.

Pupa. Length 6.5 mm. Resembles larva in general shape but is shorter and more convex. Colour reddish brown. Abdomen showing lateral tubercles conspicuous in larva, each tubercle bearing 2 or 3 long bristles. Dorsal surface of 1st thoracic segment bearing 6 pairs of minute tubercles arranged in a triangle of three on either side of a fine median white line, each tubercle bearing a long spine-like hair. Dorsal surface of each abdominal segment bears 10 minute tubercles, (4 medially and 3 lateral ones on either side) each bearing a long spine-like hair. A pair of spine-like hairs

at the base of each antenna. Tip of mesothoracic wing-pad bearing several bristles. Distal ends of femora each bearing a pair of minute tubercles tipped with long spine like hairs. Ventral surface of each abdominal segment bearing several tubercles and spine-like hairs, those on last two segments being the most prominent. By reason of this armature and abdominal movements, the pupa can move quickly and readily.

EXPLANATION OF PLATE XI.

Figs. 1 and 3. Oak leaves showing mines of *C. rubra*.

Fig. 2. *Chalepus rubra* (after Chittenden in Bull. 38, N. Ser., U. S. Div. Ent.).

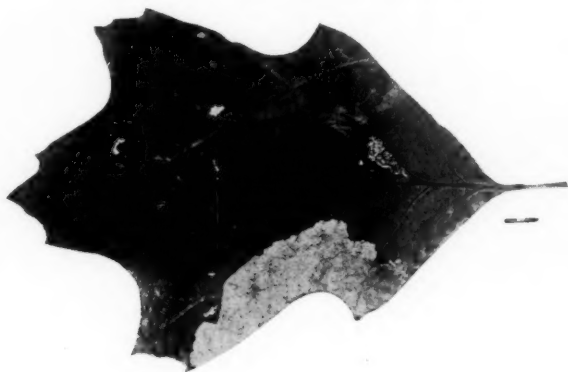
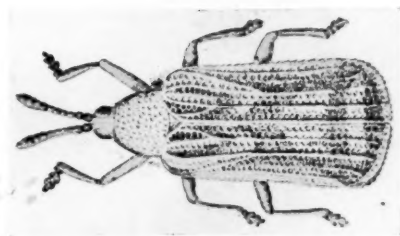
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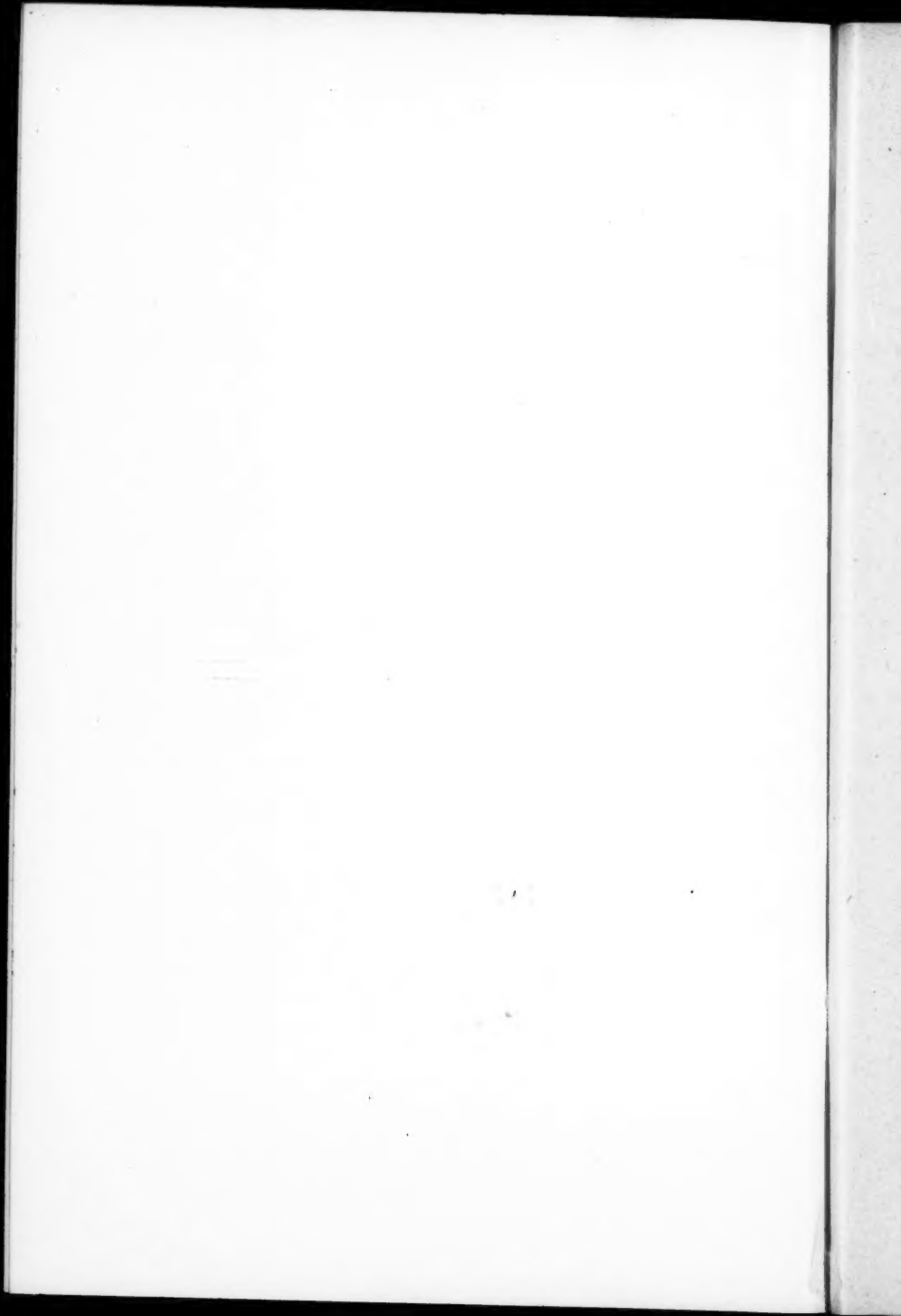
An Assistant Entomologist in the Entomological Branch of the Department of Agriculture in Grade "C" of the First Division at an initial salary of \$2,200 per annum. Candidates must be graduates of a recognized university, and must possess a good working knowledge of the classification of the orders of insects in addition to any special knowledge they possess of particular groups. Candidates should submit a statement of their training, experience and other qualifications, also a list of the entomological papers published by them, together with copies of such papers when possible.

Applications should be sent at the earliest possible date to the Secretary of the Civil Service Commission, Ottawa, from whom application forms may be obtained. Particulars with regard to the duties of this position may be obtained from the Dominion Entomologist.

December, 1918



CHALEPUS RUBRA, ADULT AND LARVAL MINES IN OAK LEAVES.



THE LIFE-HISTORY AND EARLY STAGES OF CORYTHUCHA PARSHLEYI GIBSON.

BY HARRY B. WEISS AND EDGAR L. DICKERSON, NEW BRUNSWICK, N.J.

This species was described by E. H. Gibson in the Trans. Amer. Ent. Soc. XLIV, 69-104, April 4, 1918, from specimens collected by us on walnut at Hammonton, N.J. In the above publication, Gibson states that the food plants are walnut and juneberry (*Amelanchier intermedia*). When we first collected this species on walnut, specimens were submitted to Mr. Parshley together with specimens of *C. cydonia* from juneberry. When Mr. Parshley sent the specimens to Mr. Gibson for description, it is quite possible that the host labels might have been accidentally changed. However, repeated visits to the type locality, Hammonton, N.J., and numerous examinations of both walnut and juneberry have resulted in finding the species only on the former plant.

In New Jersey we have found *parshleyi* at Hammonton on butternut (*Juglans cinerea*), walnut (*Juglans nigra*) and Japanese walnut (*Juglans siboldiana*), and at Cedarville and Bridgeton on walnut. An additional locality in New Jersey is Ramsey, by Dr. F. E. Lutz. Records of its occurrence outside of New Jersey are: Lake Waccamaw, N.C., April 20, (on pecan) (R. W. Leiby) and Great Falls, Va., Sept. 5, (on walnut) (Coll. of H. G. Barber). It undoubtedly occurs in many other localities and is possibly wrongly labeled in collections as *Corythucha juglandis* Fitch.

The following observations relative to *C. parshleyi* were made at Hammonton, which is in the southern part of New Jersey. Overwintering adults appeared about the middle of May, and during the third and fourth weeks of this month egg laying was well under way. From one to four eggs were laid in the angles formed by the mid-rib and the side ribs on the under leaf surfaces. Some eggs were found upright in the leaf close to the mid-rib and removed from the vein angles, while others were inserted in the base of the mid-rib, projecting parallel to the leaf surface. Most of them, however, were found in the vein angles in groups of two or three, each egg being more or less perpendicular to the leaf surfaces. Here they were partly hidden by pubescence, only the

December, 1918

black, conical tops being visible. Most of the eggs were found in the basal half of the leaf, and none at the tips where the veins were finer. The basal ends were inserted only slightly in the tissue, and each egg could be easily removed.

By the third week in June, a few second stage nymphs, many third and fourth, and a few fifth, were found. By the end of the first week in July, quite a few adults of the first brood were present together with many fifth stage nymphs. Eggs were deposited soon afterward in uninfested leaves, and during the last week in July first stage nymphs of a second brood were observed. During the last part of August and first part of September adults of a second brood appeared and later went into hibernation. Thus it is seen that there are two generations, each requiring about six weeks. On account of the extended oviposition period, it is possible at times to find all nymphal stages and adults and more or less overlapping of the broods takes place.

After hatching, the nymphs feed in colonies on the under leaf surface, causing a discoloration of the upper surface. In severe infestations, the leaves become yellow and dry, and many fall to the ground. The dorsal surfaces of all nymphs are covered with minute spines in addition to the larger tubercles and spines. As the nymphal stages advance, the insects tend to become broader and flatter; the lateral margins become flatter and more conspicuous, and the spines and hairs more pronounced.

Egg.—Length 0.51 mm. Greatest width 0.14 mm. Elongate oval, slightly curved when viewed laterally. Basal end rounded, gradually narrowing to distal end, which is covered with a conical cap, below which is a constriction. Widest at basal third. Basal one-half to one-third translucent, remainder dark brown to black.

First Nymphal Stage.—Length 0.5 mm. Greatest width exclusive of spines 0.2 mm. Broadly elliptical. General colour brown, lightest at posterior end of thorax and anterior end of abdomen. Fine median dorsal line beginning on head and extending through the second abdominal segment. A single broad, dorsal light band extending from head to posterior end of abdomen. Entire dorsal surface covered with minute spines. Eyes not

prominent consisting of a group of five ommatidia. Antennæ one-fourth to one-third the length of the body, translucent, bearing several hairs. Head with two minute tubercles on front each bearing a hair, a divided tubercle on vertex bearing two fine hairs and a pair of tubercles on dorsum each bearing a hair on tip and another one posterior. A pair of median tubercles on mesothorax each bearing a hair. A pair of median tubercles on second abdominal segment each bearing a hair. A pair of more prominent median tubercles on the 5th, 6th, 8th and 9th abdominal segments each bearing a single spine-like hair on the tip. Tubercles on the 5th, 6th and 8th abdominal segments also bear two longer spine-like hairs anterior to spine-like hair at tip. A single lateral spine-like hair arising from tuberculate base on pro- and mesothorax, and all abdominal segments beginning with the second. Ventral surface light; rostrum translucent, one-half the length of the body; legs translucent tinged with brown, tarsi tipped with pair of claws.

Second Nymphal Stage.—Length 0.75 mm. Greatest width exclusive of spines 0.4 mm. Narrowly oval to broadly elliptical, posterior end obtusely round, sides margined. Colour brown, light median dorsal line beginning on head and extending through the pro- and mesothorax broadening into a central dorsal light spot on the metathorax and the first and second abdominal segments. Dorsal armature similar to that of the first stage but more pronounced, lateral spine-like hairs becoming spines. Each lateral spine on the pro- and mesothorax has a minute spine posterior to it. Antennæ and eyes similar to those of first stage. Median portion of ventral surface light; beak translucent, one-half the length of the body. Legs similar to those of first stage.

Third Nymphal Stage.—Length 1.0 mm. Greatest width exclusive of spines 0.52 mm. Broadly oval, obtusely rounded at posterior end. Colour similar to that of preceding stage but somewhat darker. Lateral margins of 1st and 2nd abdominal segments light. Dorsal armature somewhat similar to that of preceding stage but more prominent. Lateral tubercles of pro- and mesothorax each bearing a prominent spine and four minute spines surrounding it. Lateral tubercles of abdomen more pronounced,

each bearing a hair on inner side. Legs, antennæ and rostrum white tinged with brown, otherwise similar to those of preceding stage.

Fourth Nymphal Stage.—Length 1.31 mm. Greatest width exclusive of spines 0.71 mm. Shape oval. Colour dark brown, fine V-shaped light line on median dorsal surface of head, connected with fine median dorsal line extending through the prothorax and broadening to a light spot extending to posterior margin of 2nd abdominal segment. Lateral posterior margin of prothorax and lateral margins of first three abdominal segments light. A small, light, dorsal median spot on 8th abdominal segment. Lateral tubercles and all spines light. Antennæ, legs, rostrum and median portion of ventral surface light. Lateral margins of pro- and mesothorax lobed. Lobes of mesothorax extending beyond posterior margin of first abdominal segment. Head with pair of spines on front, tubercle on vertex bearing a pair of spines with a smaller one anteriorly and posteriorly, pair of tubercles on dorsal surface bearing one prominent and five smaller spines. Prothorax bearing a pair of dorsal median spines and a smaller pair posterior to them. Mesothorax bearing pair dorsal tubercles each bearing a spine and posterior to the spine two hairs and a smaller spine. Other tubercles and spines of dorsal surface similar to but more pronounced than those of preceding stage. Prothorax with two minute and one larger spine on anterior lateral margin and one large and three smaller spines on outer angle of lobe. Tubercle on lateral margin of mesothorax bearing three spines and two hairs and anterior to tubercle are two spines on the lateral margin. Lateral margins of abdominal segments beginning with the second, each bearing a spine on tuberculate base and an inner side of each spine, a hair. Beginning with the fourth abdominal segment, there is an additional spine below each lateral spine. Antennæ one-third to one-half the length of the body. Rostrum extending to abdomen.

Fifth Nymphal Stage.—Length 1.9 mm. Greatest width exclusive of spines 1.2 mm. Broadly oval, sides flattened. Colour dark brown except following portions which are light; legs, antennæ, rostrum, majority of spines and tubercles, fine V-shaped

line on dorsal portion of head connecting with fine median line extending to posterior portion of prothorax where it connects with a subquadrate spot, lateral posterior margins of prothorax, central portion of metathorax between tubercles, posterior half of mesothoracic lobes, lateral margins of 6th, 7th and 8th abdominal segments, dorsal median spots on 6th, 7th, 8th and 9th abdominal segments, 1st, 2nd and most of 3rd abdominal segments. Ventral surface dark brown except light median band extending from front of head to 8th abdominal segment and the 1st, 2nd and outer portion of the 3rd abdominal segments which are also light. Lobes of mesothorax extending to 5th abdominal segments, sides of lobes somewhat angulated. Head with a pair of elongate spines on front, a tubercle on vertex bearing a pair of elongate spines and a short one anterior and posterior to this pair, a pair of elongate tubercles on dorsum of head, each bearing six elongate spines of varying lengths. Prothorax with sides broadly lobed, four spines in centre arising from a tuberculate base and a pair of smaller spines arising from a posterior light area, anterior margins of prothoracic lobes bearing three short spines, posterior to these arises a long one, posterior to this long one, there is another of similar length, on lateral posterior angle of lobe is a tubercle bearing five spines of varying length and a short hair interiorly. Mesothorax with a pair of dorsal tubercles on either side of light area each bearing three spines, lateral margin bearing two spines on outer angle of lobe and two minute ones posterior to these; posterior to the two minute ones there is a tubercle bearing three or four spines. Second abdominal segment bears a pair of median dorsal spines. Fifth, 6th, 8th and 9th abdominal segments each bear a pair of median, dorsal tubercles from each of which arises a single spine with two hairs anterior to it. Lateral margins of abdominal segments four to eight bear a single tuberculate spine from base of which arises two smaller spines and a hair. Eyes prominent, consisting of a number of ommatidia. Antennae four-jointed, sides parallel, apical joint slightly clavate, second joint two-thirds the length of the first, third joint three times the combined lengths of the first and second, fourth joint slightly longer than the first and second combined. Two apical joints bearing several long

hairs. Legs somewhat hairy, tarsi bearing two strongly curved claws. Rostrum extending to metathoracic segment.

Adult.—Length 4 mm., width 2.3 mm. This was described by Gibson as mentioned in the first part of this account. Gibson states in discussing *C. juglandis*, which is also found on walnut, that both *juglandis* and *parshleyi* occur in the type series of *juglandis* in the Fitch collection, and that this probably accounts for the more or less vague conception of *juglandis* Fitch. He states that *juglandis* is somewhat smaller than *parshleyi* and has the apical band straight across the elytra, while in *parshleyi*, the apical band runs obliquely from the costal margin toward the inner margin of elytra and is narrower. Gibson also states that *juglandis* Fitch occurs throughout New England and south and west to Kansas and Texas, its food plants including walnut, butternut and linden. This means that it undoubtedly occurs in New Jersey, but up to the present we have not been successful in locating any species other than *parshleyi* on walnut.

THE VARIETIES OF THE DRAGONFLY, *AGRION* *ÆQUABILE* (SAY).

BY CLARENCE HAMILTON KENNEDY, CORNELL
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This living jewel with its metallic green body and crystal wings tipped with jet, flutters before the collector through the shadows of wooded streams from Maine to California, while its awkward nymph may be found crawling through the dense mats of willow and alder roots that hang in the woodland pools. Because of this timid and weak flight of *æquabile* as well as the rather special environment preferred by the nymphs, this species is seldom continuously spread in any region but is met on those occasional streams, which furnish its special requirements in patchy light, and root masses hanging in fairly clear water. As a result of this low ability to spread and the distance between broods because of the special environment required, this species has developed several marked varieties.*

By reference to the plate the reader can see at once the dif-

*This same tendency to the development of varieties in the weak-flying Agrionine dragonflies is discussed by MacLachlan, "Notes on Odonata collected by Buckley in Ecuador," Trans. Ent. Soc. Lond., 1881, p. 25

December, 1918

ference between these varieties, as all the figures are from the types except those for var. *æquabile*, which are from material in the Cornell collection and those of var. *yakima*, which are drawn from material collected by the writer in the type locality. All of these varieties undoubtedly intergrade because intergradations were found between var. *yakima* and var. *californicum*, and in a letter to Mr. Williamson, Dr. E. M. Walker states that such intergradations exist between var. *æquabile* and var. *hudsonicum*. The figures show that the five varieties can be grouped into two groups by the extent of colour on the male fore wing. Varieties *æquabile*, *coloradicum* and *hudsonicum* have the black of the front wing covering half the distance or less from the nodus to the tip. These are species of the eastern United States. Varieties *yakima* and *californicum* have the black of the front wings extending over more than half the space between the wing tip and the nodus. These are Pacific Coast forms.

Because of the plate, keys are unnecessary, and further notes are given under each variety heading.

***Agrion æquabile æquabile* (Say).**

Jour. Acad. Phila., 8, p. 33, 1839. (Calopteryx).

♂ and ♀ types in the Mus. Bost. Soc. Nat. Hist.

The writer has not seen these types so the authority for their location is Muttkowski's Catalogue. This is the widely distributed eastern form that ranges across the northern states from Maine to Iowa. Probably it will be found even farther west in the Missouri River Valley. It has the least colour in its wings of any of the varieties excepting possibly *coloradicum*. It is found in all collections.

***Agrion æquabile coloradicum* Cockerell.**

Psyche, 20, p. 173, 1913.

♂ type in the U. S. Nat. Mus.

The figures are drawn from the type. The female is unknown. This variety is from the high mountains of Colorado and differs from *æquabile* in having slightly more colour in the wings. It is the least distinct of the series of varieties. In the U. S. Nat. Mus. collection is a specimen from Ft. Collins, Colorado, identified by Dr. Banks as *hudsonicum*. I am inclined to call this *coloradicum*,

though it has more colour in the front wing than the type. Probably a good series would show that *coloradicum* and *hudsonicum* intergrade.

***Agrion æquabile hudsonicum* (Hagen).**

Proc. Boston Soc. Nat. Hist., 18, p. 22, 1875.

♂ and ♀ types in the Mus. Comp. Zool., Cambridge, Mass.

The types plus the thorax and wings of a third specimen are all from Michipicoten, Lake Superior. These are the only specimens of this variety that the writer has found in United States collections. I think this has been taken recently by Dr. Walker. It is characterized by the combination of little colour in the front wing and much colour in the hind wing. As was stated at the beginning of the article, this is said by Dr. Walker to intergrade with var. *æquabile*.

***Agrion æquabile yakima* (Hagen).**

Psyche, 5, p. 248, 1890.

♂ and ♀ types in the Mus. Comp. Zool., Cambridge, Mass.

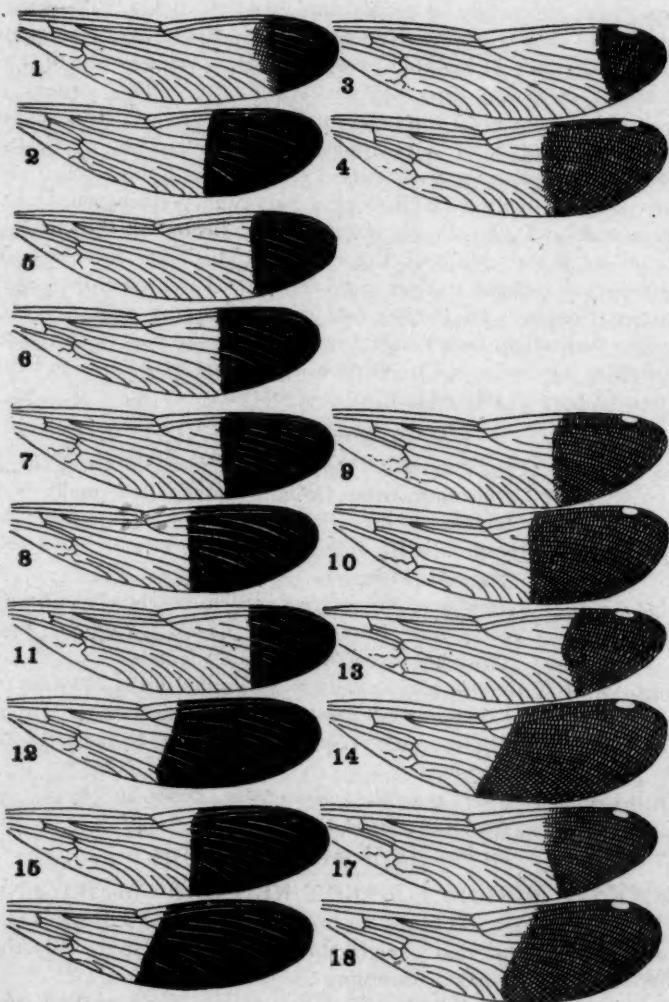
Dr. Banks kindly re-examined the types of this species for the writer and states that in the male the black in the front wing reaches barely more than half the distance from the tip to the nodus, and in the hind wing about two-thirds of the distance. While the types are from the Yakima River, (Wash.), this is the variety distributed through the Columbia River Valley. It has been recorded from Montana, (Elrod; Sci. Bull. Univ. Mont., p. 150-151, 1902), but the writer has seen none of the Montana specimens. A single male specimen is in the Cornell collection from Corvallis, Oregon. This is on the Willamette River, west of the main range of the Cascade Mountains, and, therefore, outside of the main Columbia River Valley, though the Willamette is a tributary of the Columbia. This variety intergrades with the next as is discussed in the succeeding section.

***Agrion æquabile californicum* Kennedy.**

Proc. U. S. Nat. Mus., 52, p. 483-484, 1917.

♂ and ♀ types in the U. S. Nat. Mus., Washington, D. C.

This form has the most colour on its wings of any of the varieties of *æquabile*. The hind wing is as extensively coloured as in *hudsonicum*, and the front wing has the colour extending more than half way from the tip to the nodus. It is known from the



VARIETIES OF *AGRION ÆQUABILE* SAY.

types from the collection of Mr. and Mrs. Reynolds. The specimens were caught by Mr. Nunenmacher at Blue Lake, Humboldt Co., California. Other slightly less typical specimens are in Dr. Calvert's collection from Seattle, Washington. This variety is probably a member of the fauna of the narrow, very humid coast strip extending from northern California to southern Alaska. Various other species have dark forms in this humid belt. In the collection of the U. S. Biological Survey in Washington, D. C., are a male and a female *Agrion æquabile* collected on the Owyhee River, at Rome, Malheur Co., Oregon, which are intermediate between var. *yakima* and var. *californicum*. These are from south-eastern Oregon. The writer had thought at first that the var. *californicum* might be a Pacific Coast extension of var. *hudsonicum*, but since the Malheur Co., Oregon, specimens have come to light it seems more closely related to var. *yakima*.

EXPLANATION OF PLATE XII.

- Figs. 1-4. *Agrion æquabile æquabile*, specimens in the Cornell collection from Orono, Maine. 1-2 male, 3-4 female.
- Figs. 5-6. *Agrion æquabile coloradicum*, male type in the U. S. National Museum. Female unknown.
- Figs. 7-10. *Agrion æquabile yakima*, specimens in the writer's collection from Satus Creek, Yakima Co., Washington. 7-8 male, 9-10 female.
- Figs. 11-14. *Agrion æquabile hudsonicum*, types in the Museum of Comparative Zoology, Cambridge, Mass., from Michipicoten, Lake Superior. 11-12 male, 13-14 female.
- Figs. 15-18. *Agrion æquabile californicum*, types in the U. S. National Museum from Humboldt Co., California. 15-16 male, 17-18 female.

NOTE ON AGRION ÆQUABILE HUDSONICUM (HAGEN).

Mr. Kennedy has asked me to add any remarks to his paper on *Agrion æquabile* that I might think desirable. I have only the following note to make concerning the race *hudsonicum*.

I have four much broken males of *A. æquabile* from the Kenogami River, Ont., on the Hudson Bay slope, north of Lake Superior, taken by Mr. W. J. Wilson in 1904. They were all taken within

December, 1918

3 miles of the mouth of the Flint River. Two of them are dated July 9, another July 8, the fourth, August 8. This last specimen is peculiar in having only the front wings darkened apically, though quite mature. The others are all of the race *hudsonicum*, although one of them approaches the race *aequabile* slightly in having a little less black on the hind wings.

I have also a series from several parts of Algonquin Park, Ont., which is on the edge of the Canadian Zone. Some of these specimens are typical *hudsonicum*, and on the whole they are quite similar to the Kenogami River specimens. Another series, taken at Kitchener, Ont., (formerly Berlin), by W. J. Fraser have, on an average, slightly less black on the apices of the wings than the Algonquin Park specimens. Some of these are typical *aequabile* except that the black area of the front wings is perhaps a little smaller, while others are nearer *hudsonicum* and cannot be distinguished from Algonquin Park specimens.

Hudsonicum tends to be a larger, stouter race than *aequabile*.

E. M. WALKER.

NEW NEARCTIC CRANE-FLIES (TIPULIDÆ, DIPTERA). PART VI.

BY CHARLES P. ALEXANDER, LAWRENCE, KANS.

(Continued from Page 386.)

***Tipula kansensis*, new species.**

Coloration pale brownish yellow; the mesonotal præscutum with five narrow, dark brown lines; antennal flagellum dark brown; wings with a white and brown picture on a pale brownish gray ground; male hypopygium with the ninth tergite small, deeply impressed medially to form two tumid halves; ninth pleurite produced into a flattened, chitinated lobe that is truncated apically; two pendulous, fleshy lobes in the notch of the ninth sternite.

Male.—Length 17 mm.; wing 15.3 mm.

Frontal prolongation of the head long, grayish brown; nasus indistinct; palpi with the three basal segments brownish yellow, the terminal segment dark brown. Antennæ rather short, the first three segments brownish yellow, the flagellum dark brown; the basal enlargements of the segments a little darker. Head grayish brown, with a distinct impressed median line.

Mesonotal præscutum brownish yellow, the usual stripes
December, 1918

represented only by dark brown margins, there being five such narrow lines, of which the lateral ones are broadest; remainder of the mesonotum grayish yellow, with numerous black setigerous punctures. Pleura yellow, sparsely gray pruinose. Halteres short, yellow, the knob, except at the tip, dark brown. Legs with the coxæ and trochanters yellow; femora dull yellow, the tips indistinctly brown; tibiae brownish yellow; tarsi similar, the terminal segments darker. Wings mottled with brownish gray and whitish; costal cell yellow; subcostal cell similar but even more intense; stigma yellowish brown; membrane brownish gray, with darker spots at the origin of the sector and along the cord; large whitish areas along the cord extending from *R* through cell *Cu*¹ to the wing margin; a pale area beyond the stigma in cell 2nd *R*¹ and the base of *R*²; cell *M*¹ largely pale; two large, pale areas in the first anal cell. Venation: *R*² long, a little longer than the petiole of cell *M*¹; cell 1st *M*² small, the punctiform *m-cu* inserted at about one-third to one-fourth its length.

Abdominal tergites brownish yellow, becoming darker near the hypopygium; an indistinct, interrupted, brown sublateral stripe; basal segments broadly ringed with silvery; sternites brownish yellow. Male hypopygium rather large. Ninth tergite small, deeply impressed dorso-medially to form two tumid halves; caudal margin flattened, with a deep, V-shaped median notch, the adjacent lobes subacute, reddish, each with a small, U-shaped lateral notch. Ninth pleurite incomplete, the pleural suture deep, the dorsal posterior margin of the pleurite produced dorsad into a flattened, chitinized margin that is truncated apically; outer pleural appendage small, slender, cylindrical. Dorsal inner angle of the ninth sternite with two pendulous, fleshy lobes hanging in the notch of the sternite, these tumid and clothed with abundant long, pale hairs; eighth sternite large, the caudal margin almost straight medially, with a broad fringe of long yellow hairs; the lateral lobes produced.

Habitat.—Kansas.

Holotype.—♂, Lawrence, Douglas County, Kansas, June 4, 1918.

Tipula alaska, new species.

Antennæ with the flagellum uniformly pale brown; meso-

notum dull yellow, the præscutum with three brown stripes; wings subhyaline or with a very indistinct pattern; abdomen yellow, trivittate with reddish brown; male hypopygium with the ninth tergite large, flattened, narrowed posteriorly and with a very deep median notch.

Male.—Length 17 mm.; wing 17.7 mm.

Female.—Length 20 mm.; wing 17.5 mm.

Frontal prolongation of the head moderately elongated, dull brownish yellow, the nasus very small. Antennæ of the male moderately elongated, the scape yellow, the flagellar segments uniformly pale brown; basal swelling of the flagellar segments not conspicuous. Head brownish yellow.

Thoracic dorsum dull yellow, the mesonotal præscutum with three dark brown stripes, the median one a little paler and bisected behind, the lateral stripes continued backward on to the scutal lobes; scutellum dark brown, more yellowish laterally; postnotum dull yellow medially, brown on the sides; a delicate capillary brown line extends from the præscutum backward to the base of the abdomen. Pleura dull yellow, the mesosternum and the mesepisternites brown. Halteres pale, the knobs, except the tips, paler. Legs with the coxæ dull yellow, the cephalic face of each more brownish; trochanters dull yellow; femora yellow, the tips broadly dark brown; tibiæ and tarsi similar, the tips of the individual segments narrowly darker. Wings grayish, the stigma more yellowish brown outwardly; a broad oblitative streak along the cord continued into the base of cell M^4 . Venation: basal deflection of R^{4+5} short or punctiform; basal deflection of Cu^1 from one-third to one-fourth the length of cell 1st M^2 .

Abdomen dull yellow, the segments narrowly ringed caudally with silvery; tergites beyond the base with a narrow, indistinct, reddish-brown stripe that is interrupted at the posterior margins of the segments; lateral margins of the segments with a conspicuous triangular reddish-brown blotch; basal sternites yellowish, terminal sternites darker coloured. Male hypopygium moderately enlarged. Ninth tergite large, flattened, narrowed posteriorly, with a very deep median notch, the lobes formed being elongate, flattened, a little divergent, the tips subacute; the tergite is dark brown on each side of the base, the apex yellowish. Ninth pleurite

incomplete, the suture well indicated beneath, the posterior margin of the pleurite produced caudad into a slender point; ventrad of the pleurite is a large, greenish, fleshy lobe; outer pleural appendage pale, rather small; club-shaped, the base constricted, the outer face with long, scattered hairs. What appears to be the gonapophyses of the penis-guard project caudad as two acute chitinized points. Eighth sternite rather large, the caudal margin pale, the median area flattened, transverse, finely fringed with reddish hairs, the lateral angles produced caudad and provided with a few strong, decussate bristles and a few smaller hairs. Female ovipositor with all the valves slender, subequal in length, the tips of the dorsal valves bluntly rounded.

Habitat.—Alaska.

Holotype.—♂, head of the Tsirku R., Alaska, July–August, 1910.

Allotype.—♀, with the type.

***Tipula flavibasis*, new species.**

Size small (wing under 14 mm.); antennæ of the male elongated, bicolorous, the basal enlargement of each segment yellow, the remainder black; mesonotum yellowish brown without distinct stripes; wings with a strong gray tinge.

Male.—Length 11.5–12 mm.; wing 12.2–12.7 mm.; antennæ about 4.5–5 mm.

Female.—Length 16 mm.; wing 12.3–13.3 mm.

Frontal prolongation of the head yellowish brown; nasus not distinct. Palpi with the basal segments brown, pale at the joints, the terminal segments more yellowish. Antennæ of the male elongated, the scape dull yellow, the first flagellar segment pale yellowish brown on the basal half, dark brownish black on the apical half; remaining flagellar segments with the basal swelling yellow, the pedicel black. Head gray, the occiput more yellowish the inner margin of the eyes narrowly pale gray.

Mesonotum yellowish brown, the usual stripes poorly indicated. Pleura yellow with a very sparse white bloom. Halteres pale, the knobs brown. Legs with the coxæ and trochanters light yellow, femora yellow, the tips narrowly dark brown; tibiæ similar, the tips indistinctly darker; tarsi brownish yellow, the apices of the segments slightly darkened. Wings with a strong gray tinge, the

costal and subcostal cells yellow; stigma dark brown; a brown mark at the arculus; veins dark brown; obliterative streak broad, extending into the base of cell M^4 .

Abdomen with the tergites yellowish; a broad, dark brown median stripe that is interrupted at the posterior margins of the segments; a narrower sublateral stripe; sternites yellow. Male hypopygium moderately enlarged. Ninth tergite large, the caudal margin shiny with a very deep notch at the base of which is a small, acute median tooth; lateral angles prominent, flattened, subacute and slightly divergent at their apices. Ninth pleurite complete or practically so; outer pleural appendage small, cylindrical, covered with long, coarse hairs; inner pleural appendage complex, produced posteriorly into a pale, flattened, truncated lobe that is covered with abundant pale hairs, the anterior arm heavily chitinized, the tip bifid and jutting into the notch of the tergite. Ninth sternite with two pendulous lobes hanging in the notch, these lobes narrowed toward their outer ends. Eighth sternite with the posterior margin concave, the median portion with a dense transverse fringe of long, yellow hairs, near each lateral angle with about two powerful decussate bristles. Penis-guard very elongate, the tip split into two hair-like points.

The female is similar to the male; antennæ short; abdomen with the dorso-median stripe lacking, the posterior margins of the segments broadly ringed with pale; ovipositor with the valves acute, compressed, the tergal valves longest, blackened at their tips.

Habitat.—Kansas.

Holotype. ♂, Lawrence, Douglas Co., Kans., July 1, 1918.

Allotype.—♀, with the type.

Paratopotypes.—75 ♂'s ♀'s, June 28–July 3, 1918.

In the peculiar antennæ, this interesting species agrees with *T. tephrocephala* Lw., but in all other respects is a very different fly.

***Tipula flavo-umbrosa*, new species.**

Male.—Length 22 mm.; wing 21.5–22 mm.

Female.—Length 21–22 mm.; wing 18 mm.

Very similar to *Tipula umbrosa* Lw. (*inermis* Doane) but larger than that species and much more yellow throughout. The

antennae are more clearly bicolorous apically. Præscutal stripes orange instead of dark brown, the median pair narrow, widely divided by the ground-colour. Wings strongly tinged with yellow before the cord, the costal cells yellow instead of brown. Abdomen more yellowish, especially laterally. Male hypopygium with the median area of the eighth sternite with two broadly triangular teeth, the notch between them V-shaped or narrowly U-shaped. The female is similar to the male but somewhat smaller.

Habitat.—Central United States.

Holotype.—♂, Lawrence, Douglas Co., Kansas, June 6, 1918.

Allotype.—♀, with the type (M. M. Alexander).

Paratopotypes.—Several ♂ ♀.

I have examined the type of *umbrosa* at Cambridge, and have seen paratypes of *inermis*, and they both refer to the smaller dark-coloured species of this group. It is possible that still other species remain to be separated from this complex.

SOME NEW OR SCARCE COLEOPTERA FROM WESTERN AND SOUTHERN FLORIDA.

BY W. S. BLATCHLEY, INDIANAPOLIS, INDIANA.

Between December 1, 1917, and April 1, 1918, the writer was in Florida and collected Coleoptera and Orthoptera for much of the time. The most of the collecting was done about Dunedin,* a town in Pinellas County on the west coast, but in late February and early March a trip was taken to the Lake Okeechobee region, during which several days' collecting was done at each of the following places: Lakeland, Ft. Myers, LaBelle, Moore Haven** and Okeechobee City. One day was also spent on the east shore of Lake Okeechobee at the point where the Palm Beach Canal leaves the lake. The species of Coleoptera herein noted, on account of their apparent scarcity in the State, or which are regarded as undescribed forms, were for the most part taken during the winter at some one or more of the places above mentioned.

*See Canadian Entomologist, 1917, 137.

**This is a new town on the west side of Lake Okeechobee, at the point where the Caloosahatchie River formerly emerged from the lake. A large area of the old lake area southeast of the town has been drained and is now under cultivation.

December, 1918

Loxandrus brunneus, sp. nov.—Elongate-oval. Above nearly uniform dark reddish brown, strongly shining; head and last ventral segment often piceous brown. Under surface pale chestnut brown; legs, mouth-parts and three basal joints of antennæ brownish yellow, outer pubescent joints of antennæ darker. Head longer than broad, eyes prominent. Thorax slightly wider than long, sides broadly and evenly curved from base to apex; front and hind angles slightly obtusely angulate; disk smooth, its sides in front of middle declivent; median and apical impressed lines fine, entire; basal impressions linear, deep. Elytra iridescent, two and one-fourth times as long as thorax, one-fifth wider at base; sides subparallel from behind humeri to apical third, then rounded and converging to apex; striæ rather deep, their inner margin very finely crenate-punctate; intervals smooth, feebly convex, the third with the usual dorsal puncture of the genus. Length 6.3—6.8 mm.

This species differs from all others of its approximate size except *crenatus* in its usually uniform shining brown colour. This is not due to immaturity, as numerous specimens, all of the same hue, have been taken. It was frequent beneath the wash-up on the shore of Lake Okeechobee, four miles southeast of Moore Haven, March 1-3, and when uncovered ran very swiftly to the nearest shelter. It was also taken at LaBelle and has been in the writer's collection undetermined since 1911, when specimens were secured about the margins of ponds and bay-heads at Sarasota. Specimens sent to the late Frederick Blanchard were returned as unknown to him, and H. P. Loding, of Mobile, Alabama, who has a large collection of southern forms of the genus, says he has nothing like it.

Loxandrus saphyrinus Chaud.—Leng, in his "Carabidæ of Florida,"* seems to doubt both the validity of this species and its occurrence in Florida. A specimen taken at Sanford, March 28, runs only to *saphyrinus* by Le Conte's tables, and is very distinct from *reflexus* Lec. of which Leng considers it a synonym, being slightly larger, with thorax less transverse, its sides more rounded, elytral striæ more coarsely punctate and surface with iridescence much stronger, being more brilliant than in any species of the genus known to me. Chaudoir's type of *saphyrinus* was from

*Bull. Am. Mus., Nat. Hist., XXXIV, 1915, 579.

Louisiana, and there is, therefore, no reason why it should not occur in Florida.

Loxandrus flavilimbus, sp. nov.—Elongate-oval. Above dark reddish or chestnut brown, strongly shining, the side margins and hind angles of thorax, and the basal three-fourths of side margins of elytra dull red; mouth-parts, legs and under surface pale reddish brown; apical two-thirds of antennæ fuscous. Head as broad as long; eyes large, feebly convex. Thorax subquadrate, disk smooth, sides broadly but evidently curved, front angles obtuse, hind ones broadly rounded into base; median line very faint, basal impressions shallow, shorter than usual. Elytra as wide at base as thorax, slightly more than twice as long; humeri feebly curved, sides behind them almost straight for three-fourths their length, then rounded and sinuate to apex; striæ shallow, their punctures rather coarse, close-set, faint or subobsolete on apical third; intervals smooth, very feebly convex. Length 10 mm.

Beneath board near border of pond north of Dunedin; Jan. 1, rare. Loding (Ms.) says he has an unnamed specimen which he considers identical. The size, pale legs, pale margin of thorax and elytra and coarsely punctured striæ preclude it from being any of the species treated in LeConte's tables. Two or three other species or forms of *Loxandrus* are at hand which cannot be placed by his tables. The genus, as represented in Florida, is one of the largest of the Carabidæ, but is badly in need of revision.

Lebia abdominalis Chaud.—This is recorded only from Enterprise and the Biscayne Bay region. A half dozen were found beneath the debris on the shore of Lake Okeechobee, near Moore Haven, and one was beaten from oak at Lakeland.

Lebia furcata Lec.—A single specimen, the first I have taken in Florida, was beaten Dec. 17 from the dead leaves of a cabbage palmetto near Dunedin. It is listed as rare at Tampa, Crescent City and Gainesville.

Plochionus amandus Newm.—A male, typically coloured, as described by Horn,* was beaten from a mass of Spanish moss on the margin of Skinner's Hammock, north of Dunedin, Feb. 11. From the descriptions I judge that *amandus* is only a colour form

*Trans. Am. Ent. Soc., X, 1882, 146.

of *discoideus* Schaupp.† Horn (loc. cit.) records one specimen from Florida.

Onota floridana Horn.—One specimen was beaten from oak at La Belle on Feb. 26. It is a scarce Floridian species, hitherto recorded from Lake Poinsett, Haw Creek, Enterprise and Biscayne Bay.

Selenophorus chokoloskei Leng.—I find two specimens of this new form among my series of *S. palliatus*. They are labeled Dunedin, March 25, 1915. It was described from Chokoloskee and Everglade.

Selenophorus depressulus Casey.—This is undoubtedly distinct from *S. iripennis* Say, and seems to be more common in southern Florida than the latter, the specimens at hand being from Sanford, Lake Istokpoga, Ft. Myers and Dunedin, the dates ranging between Dec. 30 and March 26. It occurs beneath cover, usually in rather dry spots, about the borders of gardens and cultivated fields. From *iripennis* it may be easily separated by its wider thorax which is less narrowed basally, its hind angles broadly rounded instead of obtuse and basal depressions more finely and densely punctate. Both species have the dorsal series of punctures, characteristic of the genus, very small and they are, therefore, apt to be confused with species of *Stenolophus*.

Stenolophus carbonarius Dej.—A single specimen was taken from beneath the beach debris southeast of Moore Haven on March 1. It differs from Indiana examples only in having the sutural striæ one-third shorter. Not before recorded from Florida, though LeConte* gives the range as "Middle and Southern States."

Olla oculata sobrina Casey.—This form was described from Florida without definite locality. Schwarz (Ms.)** has noted it from Jacksonville. Specimens at hand are from that place, Gainesville, Sanford, Dunedin and Ft. Myers, all taken between Feb. 24 and April 24. About Dunedin it apparently hibernates

†Bull. Brk. Ent. Soc., II, 1886, 86.

*Bull. Brook. Ent. Soc., VI, 1883, 14.

**The Schwarz (Ms.), referred to frequently in this paper, is an annotated copy of his "Coleoptera of Florida," in which all additional species of Florida Coleoptera taken by himself and others, up to within the last few years, are carefully recorded, with localities, dates, etc. Through the kindness of Mr. Schwarz I was able to borrow this annotated list from the Smithsonian Library and made a copy of all the manuscript additions and records.

in bunches of Spanish moss, but has been taken also from oak and plum trees.

Psyllobora parvinotata Casey.—Several specimens taken by beating on Hog Island. A sub-maritime species known from Haulover, Palm Beach and Key West. Distinguished by its lack of antescutellar spot of pronotum and small, isolated, drab spots of elytra, the general colour also paler than in *20-maculata*. Leng regards it as only a variety.

Psyllobora pallidicola Blatch.—This small Coccinellid was described* as a variety of *P. 20-maculata*, but further study of its habits and characters led me to believe it a valid species. It is always smaller, non-alutaceous and wholly without spots on thorax. As P. N. Timberlake, Entomologist of the Hawaiian Sugar Planters' Experiment Station at Honolulu, was studying the male genitalia of Coccinellidæ, I sent him specimens of *pallidicola* for examination. Under date of Dec. 7, 1917, he wrote: "At your request I have compared the male genitalia of your *Psyllobora pallidicola* with *20-maculata* and have found considerable differences, the principal one of which resides in the length of the ædeagus. In *pallidicola* the ædeagus is very short compared with *20-maculata*, in which species it is drawn out like a whiplash. *P. tædata* Lec. and *borealis* Casey, are similar if not identical with *20-maculata* in this respect, and I doubt whether they are anything more than geographical variants. *P. pallidicola*, however, is undoubtedly distinct."

About Dunedin *P. pallidicola* occurs frequently throughout the winter on oak and wax myrtle, but is never taken with *20-maculata* which is there a scarce species. The former has also been taken at Lakeland, Ft. Myers and La Belle, and is probably widely distributed throughout central and southern Florida, and north at least as far as Ormond.

Hyperaspis nigrosuturalis, sp. nov.—Broadly oval or subhemispherical, convex. Black, shining; front of head, apical angles and side margins of thorax to behind middle, yellow. Elytra red, their basal sixth, a very narrow margin and wider sutural stripe, black; the sides of the red disk connected just behind the scutellum, the sutural stripe being incomplete. Sides of ventral

*Can. Ent., 1914, 66.

segments tinged with reddish. Tarsi brownish fuscous. Upper surface distinctly and rather coarsely punctuate, the punctures separated by more than their own diameters; under surface more coarsely and shallowly punctate. Length 3 mm.

One specimen beaten from bunch of Spanish moss near the margin of a lake north of Lakeland, Feb. 22. Differs in colour from any described form. Closely related to *H. tadata* Lec. and *regalis* Casey.

Scymnus bigemmeus Horn.—Taken on Hog Island Jan. 20 and Feb. 9 by beating vegetation just back of the skirting fringe of mangrove, *Rhizophora mangle* L. Described in 1895 from Punta Gorda and Biscayne Bay, and since recorded only from Miami.

* * * * *

Near the top of page 445 of Schwarz's "Coleoptera of Florida"* is the following: "*Anamorphus pusillus* Zimm. ms. E. rare with the preceding." The preceding referred to is *Rhymbus ulkei* Cr., which Schwarz mentions as "E. (Enterprise) rare, lives on fungus which grows on dead branches." At the bottom of the page is a footnote by Le Conte as follows: "I have not described this genus (*Anamorphus*), as its affinities are not yet clearly made out. It is a small, rounded, testaceous, hairy insect having somewhat the aspect of *Rhymbus* but without prothoracic lines; the tarsi are not dilated. The specimens at my disposal are not sufficient for a thorough investigation." It will be noted that he does not refer to the specific name *pusillus*, but only to the genus *Anamorphus*.

In 1883** Le Conte & Horn diagnosed, and, therefore, first validated, the genus *Anamorphus* as follows: "Body hemispherical; tarsi narrow, 4-jointed; prothorax with large, finely margined, basal lobe, and a basal line each side, running forwards and then curving inwards; antennæ 9-jointed, club elongate, very loose."

Henshaw in his Check List (1885, p. 49) mentions *Anamorphus* Lec., but accredits no species whatever to it. In 1906 Dury † recorded *Anamorphus pusillus* Zimm. as occurring near Cincinnati,

*Proc. Amer. Phil. Soc., XVII, 1878.

**Classification Col. N. Amer., 120.

†Journ. Cinc. Soc. Nat. Hist., XX, 251.

O., and in 1910** the writer in a key gave a brief diagnosis of the genus, based on that of Le Conte and Horn, and added: "*Anamorphus pusillus* Zimm, pale reddish brown, length 1.5 mm., has been taken by Dury near Cincinnati."

The above constitute all references which can be found in the literature available to either the genus *Anamorphus* or the species *pusillus*. Whether *pusillus* was sufficiently characterized, when it was assigned to a genus not then defined, and therefore invalid, and the species itself described only as a "small, rounded testaceous hairy insect, etc.," as set forth above, I leave for better nomenclatorial cranks than myself to settle.

A careful comparison shows that the specimen in the Dury collection differs sufficiently from two at hand from Florida to justify a new name, and as *pusillus* is known only from the description quoted, I give the principal characters of each as follows:

***Anamorphus pusillus* Lec.**—Rounded-oval or semi-hemispherical, strongly convex. Dark reddish or chestnut brown, shining, rather thickly clothed with long, semi-erect, yellow hairs; legs and antennæ dull yellow. Eyes small, coarsely faceted, widely separated. Thorax twice as wide as long at middle, sides feebly curved, hind angles rectangular, disk minutely and sparsely punctate, each puncture bearing a very slender, yellow hair; basal lobe prominent, triangular, its apex rounded, the curved basal lines very fine. Elytra one-fifth wider than thorax, their common base widely and rather deeply emarginate to receive the basal thoracic lobe; umbones prominent; sides strongly declivent; disk with numerous scattered punctures, much coarser and more distinct than those of thorax, each bearing a longer, coarser, more erect yellow hair. Under surface smooth, polished. Length 1.2 mm.

Dunedin, Fla., March 27, 1916; March 23, 1918. Both were taken while beating in Skinner's Hammock, one mile northeast of Dunedin. One of the two has the head and apical third of elytra darker than the general hue. It is probably frequent in wet hammocks throughout the greater portion of Florida, but over-

**Coleoptera of Ind., 535.

looked on account of the small size. Schwarz (Ms.) lists it also from Crescent City, Fla.

Anamorhus waltoni, sp. nov.—Larger and broader than *pusillus*, the shape hemispherical rather than oval. Colour uniform pale reddish brown. Elytral punctures much finer and more dense than in *pusillus*, the pubescence therefore thicker and more evident. Characters otherwise much the same as those of *pusillus*. Length 1.6 mm.

Named in honour of L. B. Walton of Gambier, Ohio, the recognized American authority on the Endomychidae.

Dury's record, cited above, is as follows: "One specimen July 7, taken feeding on beech log in company with *Rhymbus minor*, which species it resembles in an astonishing manner."

Nausibius repandus Lec.—Listed by Schwarz as very rare under oak bark at Tampa. A single specimen was taken at Dunedin while sweeping huckleberry and other low shrubs on Jan. 29. It is a southern form, described from the District of Columbia, and appears to be everywhere very scarce.

Ino reclusa Lec.—A single specimen was beaten March 26 from the dead limbs of the Florida button-bush, a shrub resembling the black mangrove and growing just back of the borders of the latter near the middle of Hog Island. The beetle was described from Columbus, Texas, and has not before been recorded from Florida. It is one of the smallest (2 mm.) of Cucujids, pale brown with broad head, thorax triangular, wide in front, very narrow at base, and elytra covering only half of the abdomen.

Catogenus rufus Fab.—This widely distributed species has been recorded from several stations in Florida, though only six examples have been taken by me during seven winters' collecting. It is mentioned here only to make known its power of resisting cyanide fumes. On December 15 three were found beneath the bark of a pine log and placed with other specimens in a heavily charged cyanide bottle. Five hours later they were all alive and active, though everything else in the bottle had long before "passed on." I replaced them in the bottle and left them for 24 hours, when they, too, appeared to have succumbed. They were then put in a pill box with proper label and date, and I was much sur-

prised on opening this ten days later to find two of them alive and kicking. They were for a second time "gassed" for 24 hours, and then put back with their dead companions. Some two or three weeks later I found one of them was still in "status ante bellum," so I gave him a *week's* cyanide treatment, and he never "came to" thereafter. The bottle was in almost daily use until April 1, and killed quickly all other insects placed in it up to that date.

RECENT CANADIAN PUBLICATIONS.

(Continued from Page 392)

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA.—March, 1916. No. 8. Systematic Series. Victoria, 1918. 30 pp., 3 pls.

This report contains the following papers and addresses:—

Presidential Address: G. O. Day. Pp. 4-6.

On the species of the genus Pero occurring in British Columbia: E. H. Blackmore. Pp. 7-9. Contains remarks on the genus and descriptions of the four species known from British Columbia, with notes on their distribution.

The occurrence of Glutops singularis Burgess in British Columbia: R. C. Treherne. P. 10. Records the capture of this rare but widely distributed fly at Agassiz, B. C.

An Appreciation: A. F. Winn. Pp. 11-13. Conveys greetings from the Parent Society, with words of appreciation of the work of the B. C. Branch, and a plea for co-operation among the various branches of the Society.

Further additions to the list of British Columbia Geometridæ: E. H. Blackmore. Pp. 14-20. An annotated list of 23 species and varieties recorded for the first time from British Columbia, with synonymic notes on some of the forms. Ten species are illustrated from photographs.

Larva Rearing: G. O. Day. Pp. 21-27. Describes methods of collecting and rearing Lepidopterous larvæ; largely quoted from an article by E. Rippon, in the *Entomologist*, 1915.

In Memoriam. Captain R. V. Hardy: R. S. Sherman. Pp. 29-30, with portrait.

December, 1918

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA.—March, 1917. No. 10. Systematic Series. Victoria, 1918. 31 pp., 4 pls.

The following articles appear in this number:

Presidential Address: E. H. Blackmore. Pp. 4-10.

Notes on the Lepidoptera of the Northern Okanagan: W. D. Downes. Pp. 11-13. Notes on a small collection made by the writer in this district.

Notes on the hibernation of some larvæ and the movement of Boreus on the snow: J. Wm. Cockle. Pp. 14-15. *Boreus californicus* was observed to appear on the surface of the snow shortly after each fall. They come up through the snow, but do so gradually, following up each fall as it occurs, and always keeping as near the surface as the temperature will permit.

Notes on Geometridæ new to British Columbia.—E. H. Blackmore. Pp. 16-20. Six species and eight varieties new to British Columbia are recorded. Illustrated by two plates, the first showing varieties of *Xanthorhoe defensaria*, recently described by Mr. Swett, the second 8 other forms belonging to various genera.

Fossil Insects, with special reference to those of the Tertiary Lake deposits of the Similkameen Valley, B.C.: Alfred E. Cameron. Pp. 21-29. A brief sketch of the general subject of fossil insects, with notes on a collection of 73 specimens, made by Mr. L. M. Lambe, of the Dominion Geological Survey, in the Tertiary Lake deposits of the southern Interior of British Columbia. These were studied by Handlirsch, the eminent authority on fossil insects, and the results published in vol. II of the Contributions to Canadian Palæontology (Geol. Surv. Can., 1910). The collection is believed to be of early Tertiary age on account of the absence of many families not known before Cretaceous times and the presence of a relatively large number of Diptera, particularly of the Bibionid genus *Penthetria*, which at present is almost restricted to tropical and subtropical regions. A few other forms have a similar significance. The paper also contains a general account of the geological record of insects.

In Memoriam. Tom Wilson: R. C. Treherne. Pp. 30, 31; with portrait.

December, 1918

REPORT OF THE PROVINCIAL MUSEUM OF NATURAL HISTORY
FOR THE YEAR 1917.—Victoria, B.C., 1918. 35 pp.

Entomology. By E. H. Blackmore, (pp. 09 to 0 15, with 2 plates).

This paper contains notes on some of the injurious insects of the season; an account of a collecting trip for the Museum to the Lower Fraser Valley District; a list of 14 species of Odonata, recently identified for the Museum; notes on rarer insects, taken in the Province during 1917; and an annotated list of British Columbian Lepidoptera described during the same year. The paper is illustrated by two plates from photographs, the first showing Noctuidæ, the second Geometridæ.

Economical Sprays and Spraying for 1918. By. L. Caesar, O. A. College, Guelph. Forty-ninth Annual Report Fruit Growers' Assoc. of Ont., 1917, (1917) pp. 20-25.

Insects and Fungicides. By L. Caesar, O. A. C., Guelph. 13th Ann. Rep. Vegetable Growers' Assoc. of Ont., 1917 (1918), pp. 29-32.

In these two papers the various insecticides and fungicides on the market during the season of 1918 are discussed, their characteristics and relative merits given and the prices likely to prevail stated. In the first paper the question of the substitution of arsenate of lime for arsenate of lead is considered at some length, and on account of differences of opinion in different localities on this question, the author does not recommend the former as a general substitute for the latter, though he regards it as safer to use on apples just before the blossoms burst.

The Protection of Plants. By Georges Maheux. Bull. No. 42, Dept. Agric. Prov. Quebec. July, 1918. 30 pp. Published in English and French.

A brief and concise summary of methods for the control of injurious insects and plant diseases, illustrated by numerous text figures. The matter is arranged as follows:

I. Insects injurious to all crops. Under this heading the principal types of noxious insects are described, and the general methods of control outlined.

II. Insects injurious to vegetables. The various kinds of
December, 1918

vegetables are taken up in turn, their insect enemies and diseases enumerated and the remedies indicated.

III. Insects injurious to fruit trees. Following directions for the general treatment of the orchard, the different kinds of fruit trees are taken up as in section II.

IV. Insects and diseases injurious to fruit bushes.

V. Insects injurious to cereal crops.

VI. Sprays. The general principles governing the control of chewing, sucking and boring insects are outlined, followed by the descriptions of the composition and preparation of the chief insecticides and fungicides.

From LE JOURNAL D'AGRICULTURE. Vol. 21, 1918:—

Defense de Culture. By Georges Maheux. No. 7, Jan., p. 110.

Insects nuisibles au blé. By Georges Maheux. No. 9, Mars., pp. 144.

Le travail de la Section Entomologique. By Georges Maheux. No. 10, Avril, p. 149.

From LE NATURALISTE CANADIEN. Vol. 44:—

Les Coleopteres du Canada. By J. I. Beaulne. No. 7, Jan., pp. 110-111; No. 8, Feb., pp. 123-128; No. 9, Mars., pp. 159-160; No. 11, Mai, pp. 187-191:

These parts of this useful list, which was begun in vol. 10, No. 1, 1914, complete the Dytiscidæ and Gyrinidæ and include a portion of the Hydrophilidæ. The source of the original description and the distribution by provinces is given for each species.

Une nombreuse posterité. Le puceron de la rudbeckie (Golden Glow aphid) Aphis rudbeckiæ Fish. By P. Fontanel, S. J. No. 8, Feb., pp. 115-123; No. 9, Mars, pp. 142-144; No. 10, Avril, pp. 157-159.

Describes various features of the life cycle of this aphid and makes a number of calculations based on the theoretical rate of reproduction of the species.

Notes concernant l'Hemerocampe marquée de blanc. By J. C. Chapais. No. 11, Mai, pp. 163-166. 4 figs.

A brief description of the life-history and methods of control of the White-marked Tussock Moth.

Index to Volume L.

- Acalles granosus, 59.
 Acanthocephala North and Central American species of, 237.
 Acanthocephala bicoloripes, 238.
 " confraterna, 239.
 " declivis, 241.
 " femorata, 239.
 " granulosa, 240.
 " latipes, 240.
 " terminalis, 240.
 Acmaeops, California species of, 213.
 Acrididae, Egg-laying habits of, 145.
 Acrocerops affinis, n. sp., 233.
 Acronycta, synonymic notes on, 49.
 Aeschna arida, n. sp., 298.
 Agapostemon xanthorhinus, n. sp., 343.
 Agrion aquabile, varieties of, 406.
 " aquabile aquabile, 407, 410.
 " aquabile californicum, 408.
 " aquabile coloradicum, 407.
 " aquabile hudsonicum, 408, 410.
 " aquabile yakima, 408.
 Agromyza angulicornis, n. sp., 79.
 " assimilis, n. sp., 80.
 " deceptiva, n. sp., 78.
 " indecora, n. sp., 132.
 " keys to species of, 76, 130, 178, 315.
 Agromyza similata, n. sp., 178.
 Agronomy, relation to entomology of, 253.
 Agroperina, synonymic notes on, 48.
 Agrotis, synonymy of various species of, 12.
 ALDRICH, J. M., articles by, 311, 336.
 ALEXANDER, C. P., articles by, 60, 158, 242, 381, 411.
 Alfalfa, pollination by Megachile of, 301.
 Anamorphus pusillus, 421, 422.
 " walloni, n. sp., 423.
 Andropolia, synonymic notes on, 49.
 Aneflus, California species of, 205.
 Anthobates bicolor, n. sp., 155.
 " dispar, n. sp., 154.
 " pallidus, n. sp., 156.
 Anthomyiidae, new species of, 76, 130, 178, 310, 311, 315.
 Anthonomus elegans, 59.
 " scutellaris, 59.
 Anytus, synonymy of various species of, 13.
 Aphelopus thelia, n. sp., 151.
 Aphis, black cherry, 241.
 Aphis saliceti, 89.
 " theobaldi, n. sp., 89, 92.
 Aplectoides fales, 12.
 Apple bug, green, results of spraying an orchard for, 393.
 Apterygota, in relation to ancestry of insects, 285.
 Arctia oblitterata, 9, 193.
 Argia alberta, n. sp., 257.
 " hinei, n. sp., 258.
 " solita, n. sp., 256.
 Argyresthia pallidella, n. sp., 231.
 Arphia pseudonietana, egg-laying habits of, 146.
 Augochlora, South American species of, 140.
 Autographa, synonymic notes on, 51.
 BAKER, A. C., article by, 318.
 Barnes and McDunnough's Check List of Lepidoptera, notes on, 8, 43.
 BARNES, W., article by, 192.
 Bees, some South American, 137.
 BEUTENMULLER, W., article by, 305.
 Bidessus floridanus, 52.
 BLACKMORE, E. H., article by, 213.
 BLATCHLEY, W. S., articles by, 52, 416.
 Blattella germanica, dorsal pygidial glands of, 278.
 BOOK NOTICES:
 Chagnon's Coleoptera of Quebec, 107.
 Funkhouser's Membracidae of the Cayuga Lake Basin, 179.
 Lutz's Field Book of Insects, 215.
 Piers' Orthoptera of Nova Scotia, 390.
 Proceedings of the Entomological Society of B. C., 424, 425.
 Proceedings of the Second Entomological Meeting, held at Pusa, 387.
 Studies in Kansas Insects, 108.
 Tillyard's Biology of Dragonflies, 142.
 Trelease's Plant Materials of Decorative Gardening, 107.
 Whitehouse's Odonata of Alberta, 391.
 Borolia, taxonomic notes on, 44.
 Bothrideres geminatus, 53.

- Brachynomada, species of, 26.
 subminiata, n. sp., 27.
 BRAGG, L. C., article by, 89.
 BRAUN, A. F., article by, 229.
 British Columbia, a new Sarcophaga from, 122.
 BRITTAİN, W. H., articles by, 117, 393.
 BUENO, J. R. DE LA T., article by, 24.
 Buprestidae, African, of the genus *Sternocera*, 346.
 Butterflies from Coliseum Mt., Alta., 1.
 CAESAR, L., article by, 321.
 California, Cerambycidae of, 172, 205, 281.
 Callidium, California species of, 175.
 Callococcus, n. gen., 328.
 pulchellus, 329.
 Camnula pellucida, egg-laying habits of, 147.
 Canadian publications, recent, 350, 390, 424.
 Canker worm, ecology of the spring, 267.
 Canthon perplexus, 54.
 probus, 54.
 Catocala beaniana, 50.
 unijuga, 50.
 Catogenus rufus, 423.
 CAUDEL, A. N., article by, 375.
 Cecropia caterpillar, notes on a, 289.
 Celina grossula, 52.
 Cerambycidae from the Peterborough district, 37.
 Cerambycidae of California, 172, 205, 281.
 Cerococcus ovoides, 332.
 Chalepus rubra in New Jersey, notes on, 398.
 CHAMBERLIN, R. V., article by, 361.
 Chorizagrotis, synonymy of various species of, 12.
 Cirphis, taxonomic notes on, 43.
 Cis impressa, 54.
 CLARK, G. E., article by, 115.
 Coccidae, abdominal spiracles in the, 85.
 Coccidae, key to genera of, formerly included under Sphaerococcus, 324.
 Coccidae, notes on 221, 323.
 COCKERELL, T. D. A., articles by, 26, 115, 137, 343, 348.
 Cockroach, dorsal pygidial glands of, 278.
 Calioxys bruneri, n. sp., 138.
 Cœnagrion interrogatum, 95.
 Cœnagrionidae of the Red Deer District, 95.
 Cœnurgia, synonymic notes on, 50.
 Coleoptera from Florida, 52, 416.
 Colletis chubutensis, n. sp., 137.
 rufosignatus, n. sp., 138.
 Conistra, synonymic notes on, 46.
 Conotrachelus serpentinus, 59.
 Copicucullia, synonymic note on, 44.
 Copris inemarginatus, n. sp., 54.
 Corythucha parshleyi, life-history of, 401.
 CRAMPTON, G. C., article by, 285.
 Crane-flies, new Nearctic, 60, 158, 242, 411.
 CRIDDLE, N., articles by, 73, 145.
 Crossidius, California species of, 208.
 Crustacea, in relation to ancestry of insects, 285.
 Cryptorhynchus helvus, 59.
 Cryptokermes, abdominal spiracles in, 85.
 Cryptokermes brasiliensis, 222.
 characters of, 225.
 Cutworm baits, experiments with, 187.
 DAVIS, J. J., articles by, 187, 253.
 Desmocerus, California species of, 211.
 DICKERSON, E. L., articles by, 201, 217, 401.
 Dididia greeni, n. sp., 153.
 propinqua, n. sp., 153.
 Dicraeus, generic characters of, 338.
 incongruus, n. sp., 339.
 Dicanomyia rhipidioides, n. sp., 381.
 Diplopods, two new Louisiana, 361.
 Disonycha mellicollis, 56.
 Dissosteira carolina, egg-laying habits of 147.
 Ditionia carinata, 52.
 DOD, F. H. WOLLEY, articles by, 8, 43.
 Drasteria, synonymic notes on, 51.
 DUSHAM, E. H., article by, 278.
 Ehrhonia, n. gen., 325.
 cupressi, 326.
 graminis, n. sp., 326.
 Elachiptera planicollis, 341.
 Elaphidion, California species of, 177.
 Elater sturmii, 53.
 EMERTON, J. H., article by, 128.
 Emphor bombiformis, 320.
 Empoasca trifasciata, early stages of, 201.
 Enargia, synonymic notes on, 50.
 Entomological Branch, publications of, 352.

- Entomological collections of the late W. H. Harrington, 291.
 Entomological Society of Nova Scotia, proceedings of, 350.
 Entomological Society of Ontario, 356, 364.
 Entomological Society of Ontario, annual meeting, 35.
 Entomologist wanted, 400.
 Entomology, relation of agronomy to, 253.
Epicaula watsoni, n. sp., 58.
Epitrix fasciata, n. sp., 56.
 Eremobia, synonymic notes on, 48.
Erineda aenea, n. sp., 229.
Eriocera brevipila, n. sp., 164.
 rubrimota, n. sp., 165.
Erioptera megophthalma, n. sp., 60.
 needhami, n. sp., 383.
 pilipennis, n. sp., 382.
 Eriopyza, synonymy of various species of, 16.
Erpetogomphus lampropeltis, n. sp., 297.
Erythroneura ador, n. sp., 361.
Ethojulus amphelictus, n. gen. and sp., 361.
Eupithecia harlequinaria, validity of, 214.
 Eutricopsis, synonymic notes on, 50.
 Eutylistus tristriatus, 54.
Euxoa ochrogaster, 74.
Euxoa, synonymy of various species of, 9, 193.
Feltia venerabilis, 74.
 FERRIS, G. F., articles by, 85, 125, 221, 323.
 FISHER, W. S., article by, 140.
 Florida, a new *Hoplia* from, 140.
 coleoptera from, 52, 416.
 FOLSOM, J. W., article by, 291.
Fontaria louisiana, n. sp., 363.
 Fruit-tree leaf-roller, 321.
 GAHAN, A. B., articles by, 28, 101, 133, 151, 166, 196.
 GARNETT, R. T., articles by, 172, 205, 248, 281, 346.
Gasterophilus nasalis, oviposition of, 246.
 Gelechiidae of the Heath collection, 266.
 Geometridae of the Heath collection, 225.
 Geometrid notes, 17, 293.
 GIBSON, A., articles by, 71, 181.
 GIBSON, E. H., articles by, 81, 237.
 GILLETTE, C. P., articles by, 89, 241.
Gongylus gongylodes stridulation of, 358.
Gonomyia kansensis, n. sp., 158.
 spinifer, n. sp., 384.
Gonotropis gibbosus, 114.
Gracilaria ferruginella, n. sp., 235.
 Gracilariidae, new species of, 233.
Graptolitha, synonymic notes on, 46.
 winnipeg, 195.
 Green apple bug, results of spraying an orchard for, 393.
Hadronema confraterna, n. sp., 83.
 festiva, 84.
 militaris, 83.
 picta, 84.
 princeps, 84.
 robusta, 83.
 splendida, n. sp., 84.
 Halictine bees, American, simulating *Nomioides*, 348.
 Halictine bees from Chile, new, 343.
Halictus bruneriellus, n. sp., 139.
 xanthinus, n. sp., 348.
Hapladrus ater, 57.
 HARRINGTON, W. H., entomological collections of, 291.
 HARRINGTON, W. H., obituary notice of, 181.
 Heart of a Wood-pile, the, 37.
 Heliodinidae, new species of, 229.
 Hepialidae of the Heath collection, 267.
Hesperobaenus rufipes, 53.
 Heteroptera from Parry Sound District, 24.
 HOLDRIDGE, A., article by, 237.
 HOLLINGER, A. H., article by, 23.
Hoplia floridana, n. sp., 140.
Hoplosia nubila, 110.
 HOWARD, L. O., article by, 107.
Hydraena marginicollis, 52.
Hydriomena macdunnoughi, n. sp., 296.
 notes on, 293.
Hydrolaea comata, n. sp., 312.
 orbitalis, n. sp., 311.
Hylemyia pluvialis, n. sp., 310.
Hylotrupes, California species of, 174.
 Hymenoptera described by Provancher, lectotypes of, 28, 101, 133, 166, 196.
 Hymenopterous parasite, an interesting new, 151.
Hymenorus elbertae, n. sp., 57.
Hyperaspis nigrosuturalis, n. sp., 420.
Hyperplatys aspersa, 39.
Hyppa rectilinea, 49.
 xylinoides, 49.

- Icerya*, abdominal spiracles in, 86.
 Idiotropic tendencies in insects, 358.
 Indian insects injurious to crops, 388.
Ino reclusa, 423.
 Insect collections of the Maritime Provinces, 117.
 Insect tropisms, 357.
 Insects and Myriopods, the probable ancestors of, 285.
 Ipimorpha, synonymic notes on, 50.
Isotoma macnamarai, 291.

 Japanese pest, a recently introduced, 217.
 June-beetles, destruction by light traps of, 75.

 KENNEDY, C. H., articles by 256, 297, 406.
Kuwaniina, n. gen., 324.
 parvus, 325.

Lachnosterna boops, 56.
Lachnosterna spp., control of, 253.
 destruction by light traps of, 75.
 Lamiinids, 37.
Lasiomastix subtenuicornis, n. sp., 61.
Lasiolina canadensis, n. sp., 337.
 generic characters of, 336.
Lathropus pictus, 53.
 Leaf-hoppers, Nova Scotian Eurypteryid 360.
 Leaf-roller, fruit-tree, 321.
Lebia abdominalis, 418.
 furcata, 418.
Lepidopter, a long-fasting, 363.
 Lepidoptera, notes on Barnes' and McDunnough's Check List of, 8.
 Lepidoptera, the Heath collection of, 225, 262.
Leptinillus apiodontia, n. sp., 125.
 Leptura, California species of, 248.
Leucania, taxonomic notes on species of, 44.
Leucotermes flavipes, 380.
 Libellulidæ from the Red Deer District, 96.
 Light traps as a means of controlling insects, 73.
 LILJEBLAD, E., article by, 153.
Limnophila electrina, n. sp., 115.
Liopus alpha, 41.
 variegatus, 40.
Loberus subglaber, 53.
 LOCHHEAD, W., article by, 36.

Loxandrus brunneus, n. sp., 417.
 flavilimbus, n. sp., 418.
 saphyrinus, 417.
Luperina, taxonomic notes on, 48.
Lygus communis var. *novascotiensis*, 393.

 MCATEE, W. L., article by, 360.
 McDUNNOUGH, J., article by, 192.
 MALLOCH, J. R., articles by, 76, 81, 130, 178, 310, 315.
 Mantidæ, stridulation in the, 358.
 Margarodinæ, abdominal spiracles in, 86.
 Maritime Provinces, insect collections of the, 117.
 Matuta, 13.
Megachile diligens, 301, 303.
 key to the species of the latimanus group, 301.
Megachile latimanus, 301, 303, 304.
 periherta, 301, 303, 304.
 pollination of alfalfa by, 301.
Melanoplus angustipennis, 149.
 atlanis, 148.
 bivittatus, 150.
 packardii, 150.
Microclytus gazellula, 113.
 gibbulus, 113.
 Microlepidoptera, new species of, 229.
Molophilus perflaveolus, n. sp., 160.
 spiculatus, n. sp., 161.
 ursus, n. sp., 162.
Momophana columbiana, 46.
 comstocki, 46.
Monocesta coryli, 56.
Monocrepidius aversus, 53.
 debilis, 53.
 Monophlebinæ, abdominal spiracles in, 86.
 Mordellidæ, new species of, 153.
Mordellistena frosti, n. sp., 156.
 masoni, n. sp., 157.
 nunenmacheri, n. sp., 157.
 MORRIS, F. J. A., articles by, 37, 109.
Mycetococcus, n. gen., 330.
 corticis, 331.
 ehrhorni, 330.
Myzus cerasi, 241.
Nausibius repandus, 423.
Necydalis, California species of, 211.
Nehalennia irene, 95.
Neleucania, synonymic notes on species of, 44.
Neoclytus, California species of, 210, 429.

- Nephelodes, synonymy of various species of, 16.
 NICOLAY, Alan S., article by, 398.
 Noctuid notes, 192.
 Nordegg, Alta., a week's collecting at, 1.
- OBITUARY NOTICES:
 HARRINGTON, W. H., 181.
 KEARFOTT, W. D., 71.
 KING, LIEUT. VERNON, 314.
 WOOD, S. T., 34.
- Odonata, new species from South-western States of, 256, 297.
 Odonata of the Red Deer District, 95.
 Œcophoridæ of the Heath collection, 267.
 Oeme, California species of, 176.
 Oligia, synonymic notes on, 47.
 Olla oculata sobrina, 419.
 Oncocnemis, synonymic notes on species of, 44.
 Onota floridana, 419.
Ornix spiræifoliella, n. sp., 234.
 Ortheziinæ, abdominal spiracles in, 86.
 Orthosia, synonymy of, 16.
 Oscinidæ, new and little known Canadian, 336.
Oscinis criddlei, n. sp., 341.
 " *scabra*, n. sp., 342.
 Ottawa Naturalist, the, 387.
 Oxoplus, California species of, 208.
 Ozognathus floridanus, 53.
- Pachyta, California species of, 212.
 Paleacrita vernata, ecological notes on, 267.
Paludicoccus, n. gen., 327.
 " *distictum*, 327.
 Parastichtis, synonymic notes on, 46.
 PARKER, R. R., article by, 122.
 Parry Sound District, Heteroptera from, 24.
Phenacoccus stachyos Æ P. pettiti, 23.
Pheosia dimidiata, 51.
Phuphena u-album, 49.
 Phyllogaster, supplementary note on the genus, 81.
 Phylotropic tendencies in insects, 358.
 Phymatodes, California species of, 174.
Platynus octopunctatus, 52.
Plochionus amandus, 418.
Pogonocherus, California species of, 283.
Pogonocherus mixtus, 41.
 Polia, taxonomic notes on various species of, 14.
- Popilia japonica*, 217.
Pseudagapostemon pampeanus, 139.
Pseudariotus amicus, 58.
Psyllobora pallidicola, 420.
 " *parvinotata*, 420.
 Pterophoridæ of the Heath collection, 264.
 Pyralidæ of the Heath collection, 262.
 Pyrrhia, synonymic notes on, 49.
- Red letter day, a, 109.
Rhizagratis insertans, 12.
Rhodites ashmeadi, n. sp., 306.
 " *bassetti*, n. sp., 307.
 " new species from Oregon, of 305.
Rhodites oregonensis, n. sp., 305.
 " *ostensackeni*, n. sp., 307.
Rhopalictus callicladurus, n. sp., 344.
 " *corinogaster chiloensis*, n. subsp., 344.
 " *melanocladus*, n. sp., 345.
 ROBERTSON, C. R., article by, 320.
 ROHWER, S. A., articles by, 28, 101, 133, 166, 196.
 Rothschildia jorulla, long pupal life of, 363.
 ROWLEY, R. R., article by, 363.
- Sarcophaga vancouverensis*, n. sp., 122.
 Scotogramma, synonymic notes on, 13.
Scymneus bigeminus, 421.
Selenophorus chokoloskei, 419.
 " *depressulus*, 419.
Siphocoryne capreae, 89, 93.
 " *essigi*, n. sp., 89, 94.
 " *grabhami*, 89, 94.
 " *pastinacæ*, 89, 94.
- SLADEN, F. W. L., article by, 301.
 Snow fauna, a new Isotoma of the, 291.
Somatochlora albicincta, 96.
 " *cingulata*, 97.
 " *forcipata*, 370.
 " *franklini*, 98, 374.
 " *hudsonica*, 98.
 " *incurvata*, n. sp., 367.
 " *kennedyi*, n. sp., 371.
 " *minor*, 98.
 " *semicircularis*, 99, 366.
 " *septentrionalis*, 99.
 " *walshii*, 99.
- Spharagemon bolli*, egg-laying habits of, 148.
Spharagemon collare, egg-laying habits of, 148.
Sphenophorus chittendeni, 59.

Spiders, studies of Canadian, 128.
 Spraying for the green apple bug, 393.
Stenolophus carbonarius, 419.
Sternocera interrupta ad varieties, 436.
 " *interrupta vandykei*, n. var.,
 347.
 " *stevensii*, 347.
 " " *waterhousei*, n. var.,
 348.
Stigmococcus, abdominal spiracles in,
 86.
Swammerdamia cuprescens, n. sp., 231.
 SWETT, L. W., articles by, 17, 293.
Symydobius americanus, n. sp., 319.
 " *oblongus*, 318.
Syneda, synonymic notes on, 51.
Tegrodera aloga, 335.
 " *erosa*, 333.
 " *inornata*, n. var., 334.
 " *laticincta*, 335.
 " synopsis of, 333.
Tenebroides bimaculata, 53.
Thelia bimaculata, 152.
 Tineidæ of the Heath collection, 267.
Tipula alaska, n. sp., 412.
 " *aperta*, n. n. for *T. imperfecta*,
 62.
Tipula aprilina, n. sp., 63.
 " *bergrothiana*, n. sp., 68
 " *coracina*, n. sp., 70.
 " *entomophthora*, n. sp., 385.
 " *flavibasis*, n. sp., 414.
 " *flavo-umbrosa*, n. sp., 415.
 " *helderbergensis*, n. sp., 64.
 " *huron*, n. sp., 66.
 " *kansensis*, n. sp., 411.
 " *kirbyana*, n. sp., 244.
 " *macrolaboides*, n. sp., 69.
 " *margarita*, n. sp., 243.
 " *protea*, n. sp., 242.
 " *sackentiana*, n. sp., 62.
Tipulidæ, new nearctic, 60, 158, 242,
 411.
 Tipulid fly from Baltic amber, 115.
 Tortricidæ of the Heath collection, 264.

Tortrix argyrosipila, 321.
 TOWNSEND, C. H. T., article by, 246.
 Trachea, synonymic notes on, 46.
Tricyphona protea, n. sp., 242.
 Tropisms of insects, 357.
Tropisternus sublaevis, 52.
Trox erinaceus, 55.
 TURNER, C. F., article by, 187.
Ufeus hultsii, 12.
 " *plicatus*, 12.
Ulomorpha sierricola, n. sp., 163.
Vanonus sagax, 58.
 WALKER, E. M., articles by, 34, 107,
 108, 142, 179, 215, 350, 368, 387,
 390, 410, 424.
 WALLIS, J. B., articles by, 225, 262.
 WEISS, H. B., articles by, 201, 217,
 398, 401.
 WHITE, A. G. H., article by, 289.
 White grubs, control of, 253.
 WHITEHOUSE, F. C., articles by, 1, 95.
 WILLEY, A., article by, 358.
Xanthorhoe atlinensis, n. sp., 19.
 " *blackmorei*, n. sp., 21.
 " *fossaria*, 17.
 " *macdunnoughi*, n. sp., 17.
 " *pontiaria*, 17.
Xylomiges curialis, 16.
Xylotrechus, California species of, 209.
Xyrosaris ochroplagiata, n. sp., 232.
 YOUNG, B. P., article by, 267.
 Yponomeutidæ, new species of, 231.
 Yponomeutidæ of the Heath collection,
 266.
 Zoraptera, a new species of, from the
 United States, 375.
Zorotypus hubbardi, n. sp., 375.
 " *neotropicus*, 380.

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